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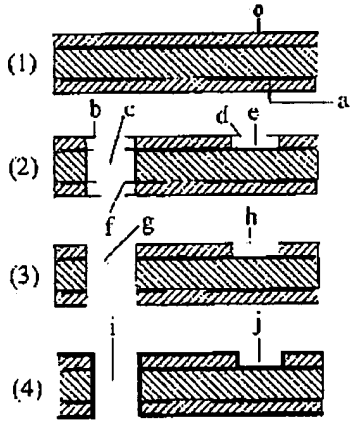
(54) BORING METHOD BY CO2 GAS LASER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a boring method which forms small pierced hole and/or blind-pierced hole by irradiating CO2 gas laser directly to the surface of a copper laminated plate.
SOLUTION: This boring method, installing metal plating o which includes nickel, on the copper-foil surface of the copper laminated plate, irradiates high power CO2 gas laser, the power of which is preferably selected from 10-60 mJ, directly to the surface of the copper laminated plate, boring exterior and inner copper foil to form a pierced hole c and/or a blind pierced hole e.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] the carbon dioxide laser of energy sufficient after giving plating which contains nickel on the copper foil front face of a copper-clad sheet to carry out perforation processing of the copper foil from on this -- a pulse oscillation -- direct -- irradiating -- a breakthrough and/or blind beer -- the perforation method by the carbon dioxide laser characterized by forming a hole
[Claim 2] The perforation method by the carbon dioxide laser according to claim 1 whose energy of a carbon dioxide laser is the energy chosen from 10-60mJ. .
[Claim 3] after this carbon-dioxide-laser perforation and a hole -- the perforation method by the carbon dioxide laser according to claim 1 or 2 characterized by carrying out etching removal of the copper foil superficially in part in the thickness direction while removing the copper foil barricade generated on the outskirts

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] the top after this invention gives plating which contains nickel on the copper foil front face of a copper-clad sheet to a direct carbon dioxide laser -- irradiating -- the breakthrough of a minor diameter, and/or blind beer -- it is related with the method of forming a hole suitable -- after perforation -- a medical fluid -- a hole -- the printed wired board obtained using the copper-clad sheet created by carrying out etching removal of the copper foil in part in the thickness direction at the same time it removes a surrounding copper foil barricade, and subsequently carrying out copper coating of the whole has the hole of a minor diameter, and is suitable for the use for [in which the minute pattern was formed / new as a high-density small printed wired board] semiconductor plastic packages
[0002]
[Description of the Prior Art] Conventionally, the high-density printed wired board used for a semiconductor plastic package etc. was performing penetration perforation with the mechanical drill. When the path of a drill turned into a minor diameter increasingly in recent years, and the aperture had become below 0.15mmphi and opened the hole of such a minor diameter, for the narrow reason, the diameter of a drill was the thing at which a drill turns at the time of perforation and which has a fault, like breaking and a working speed is slow, and has a problem in productivity, reliability, etc. Moreover, the hole of the same size is beforehand opened in the copper foil of the front reverse side by the predetermined method using the negative film. furthermore, the object for through holes which arranges what formed beforehand the same hole also as the copper foil of a inner layer by etching, and penetrates the front reverse side by the carbon dioxide laser, if it is going to form a hole Position gap of inner layer copper foil and gap of the position of an up-and-down hole were produced, and there was a fault of being unable to form the land of a faulty connection and the front reverse side.
[0003] In blind beer perforation, surface copper foil was **********ed beforehand, and from on this, the carbon-dioxide-laser energy of low energy was irradiated, and was carrying out perforation. This used the etching resist for the surface, and processes, such as exposure, development, etching, and resist ablation, are required for it, and it was inferior to workability. moreover, blind beer according [on a multilayer board and] to size contraction of a inner layer -- position gap of the copper foil of the pars basilaris ossis occipitalis of a hole etc. had become a problem Furthermore, in the printed wired board which carries out densification increasingly in recent years, thermal resistance, migration-proof nature, the electric insulation after moisture absorption, etc. are becoming a problem.
[0004]
[Problem(s) to be Solved by the Invention] this invention offers the method of forming the hole of the minor diameter for creating the high-density printed wired board which solved the above trouble.
[0005]
[Means for Solving the Problem] irradiating directly the carbon-dioxide-laser beam of energy sufficient after giving plating which contains nickel on the surface of a copper-clad sheet according to this invention to process copper foil from on this -- a breakthrough and/or blind beer -- it becomes possible to open a hole and the hole of a minor diameter can create efficiently at high speed the carbon dioxide laser of the energy preferably chosen from 10-60mJ -- upper shell irradiation of direct copper foil -- carrying out -- a breakthrough and/or blind beer -- a hole is formed In a pore, the barricade of copper foil occurs after processing. Although a barricade can also be taken by mechanical polish, etching by the medical fluid from points, such as a dimensional change, is suitable. Etching removal also of the copper foil barricade of an inside-and-outside layer is carried out at the same time it sprays a medical fluid after perforation, or it draws in and it carries out etching removal of a part of surface copper foil.
[0006] the double-sided copper-clad sheet obtained by carrying out a plating rise with copper coating after etching removal -- using -- the front reverse side -- circuit formation -- carrying out -- a law -- it considers as a printed wired board by the method In order to make the circuit of the front reverse side minute, it is desirable to make the copper foil of a front lining into the thickness of 2-7 micrometers, and poor generating of short-circuit, a pattern piece, etc. does not have it in this case, either, and it can create a high-density printed wired board. furthermore, the working speed was alike and quick compared with the case where it opens with a drill, productivity was also good, and the thing excellent also in economical efficiency was obtained
[0007]

[Embodiments of the Invention] this invention gives plating which contains nickel on the copper foil front face of a copper-clad sheet first. then, the carbon dioxide laser of sufficient energy to process copper foil from on this -- using -- a direct copper foil top -- energy -- a pulse oscillation -- irradiating -- a breakthrough and/or blind beer -- a hole is opened although the barricade of the copper foil of the front reverse side and a inner layer occurs after perforation, or it sprays an etching reagent by high pressure in this case -- drawing in -- a hole -- dissolution removal of the barricade of the copper foil of through and an inside-and-outside layer is carried out for inside then, a law -- copper coating of the whole is carried out by the method, circuit formation etc. is performed, and a printed wired board is created

[0008] Generally with copper foil required to create the copper-clad sheet used by this invention, a well-known electrolytic copper foil is mentioned. As an outside strake, as for this copper foil, a thing with a thickness of 9-35 micrometers is suitably used as an electrolytic copper foil with a thickness of 3-12 micrometers and an inner strake.

[0009] In this invention, a copper-clad sheet is the copper-clad sheet and multilayer board with which the layer of the copper of at least one or more layers exists, and that by which base-material reinforcement was carried out, the thing of a film base material, a thing resin independent [without a reinforcement base material], etc. are usable. However, points, such as size contraction, to a glass fabric base-material copper-clad sheet is desirable. Moreover, when creating a high-density circuit, although a thin thing can be used for surface copper foil from the beginning, suitably, it carries out laminate molding of the 9-12-micrometer thick copper foil, and what made thin suitably 2-7 micrometers of surface copper foil to 3-5 micrometers by the etching reagent is used for it after perforation.

[0010] Generally as a base material of a copper-clad sheet, organic [well-known] and well-known inorganic textile fabrics, and a nonwoven fabric can be used. Specifically, as inorganic fiber, fiber, such as E glass, S glass, D glass, and M glass, etc. mentions, and it is ****. Moreover, as organic fiber, the fiber of all aromatic polyamides, liquid crystal polyester, and polybenzazole etc. is mentioned. Mixing is sufficient as these. Films, such as a polyimide film, are usable.

[0011] Generally as a resin of the thermosetting resin constituent of the copper-clad sheet used by this invention, well-known thermosetting resin is used. Specifically, they are an epoxy resin and a polyfunctional cyanic-acid ester resin. A polyfunctional maleimide cyanic-acid ester resin, a polyfunctional maleimide resin, an unsaturation machine content polyphenylene-ether resin, etc. are mentioned, and they are used by one sort or two kinds or more, combining. From the point of the through hole configuration when carrying out perforation processing by carbon-dioxide-laser irradiation of a high output, a thermosetting resin constituent 150 degrees C or more has a desirable glass transition temperature, and a polyfunctional cyanic-acid ester-resin constituent is suitable from points, such as moisture resistance, migration-proof nature, and an electrical property after moisture absorption.

[0012] The polyfunctional cyanic-acid ester compound with a suitable this invention which is a part for thermosetting resin is a compound which has two or more cyanate groups in a molecule. When it illustrates concretely, 1 and 3- or 1, 4-JISHIANATO benzene, 1 and 3, 5-TORISHIANATO benzene, 1, 3-, 1, 4, -, 1, 6-, 1, 8, -, 2, 6- or 2, 7-JISHIANATO naphthalene, 1, 3, 6-TORISHIANATO naphthalene, 4, and 4-JISHIANATOBI phenyl, Screw (4-JISHIANATO phenyl) methane, 2, and 2-screw (4-cyanate phenyl) propane, 2 and 2-screw (3, 5-dibromo 4-cyanate phenyl) propane, The screw (4-cyanate phenyl) ether, a screw (4-cyanate phenyl) thioether, It is cyanate obtained by the reaction of a screw (4-cyanate phenyl) sulfone, tris (4-cyanate phenyl) phosphite, tris (4-cyanate phenyl) phosphate, and a novolak and halogenation cyanogen.

[0013] these -- others -- JP,41-1928,B -- said -- 43-18468 -- said -- 44-4791 -- said -- 45-11712 -- said -- 46-41112 -- said -- polyfunctional cyanic-acid ester compounds given in 47-26853, JP,51-63149,A, etc. -- using -- ****** Moreover, molecular weight 400-6,000 which has the triazine ring formed of 3 quantification of the cyanate group of these polyfunctional cyanic-acid ester compound A prepolymer is used. the polyfunctional cyanic-acid ester monomer of the above [this prepolymer] -- for example, acids, such as a mineral acid and a Lewis acid, --; sodium alcoholate etc. is obtained by carrying out a polymerization, using salts [, such as a base; sodium carbonate,], such as tertiary amines, etc. as a catalyst In this prepolymer, the unreacted monomer is also contained in part, the gestalt of the mixture of a monomer and a prepolymer is carried out, and such a raw material is used suitable for the use of this invention. It is used making it dissolve in the meltable organic solvent generally.

[0014] Generally as an epoxy resin, a well-known thing can be used. The poly epoxy compounds which specifically epoxidated double bonds, such as the liquefied or solid bisphenol A type epoxy resin, a bisphenol female mold epoxy resin, a phenol novolak type epoxy resin, a cresol novolak type epoxy resin, a cycloaliphatic epoxy resin, a butadiene, a pentadiene, a vinyl cyclohexene, and the JISHIKURO pentyl ether; the poly glycidyl compounds obtained by the reaction with a polyol, hydroxyl-group content silicon resin, and EPOHAROHI drine compounds are mentioned. These may be used by one sort or two kinds or more, combining them.

[0015] Generally as polyimide resin, a well-known thing may be used. Specifically, they are the reactant of polyfunctional maleimide and polyamine, and JP,57-005406,B. The polyimides of the end triple bond of a publication are mentioned. Although it is used even when these thermosetting resin is independent, it is good to use it, considering the balance of a property and combining suitably.

[0016] According to a request, various additives can be blended with the thermosetting resin constituent of this invention in the range by which the property of constituent original is not spoiled. As these additives, polymerization nature double bond content monomers, such as a unsaturated polyester, and the prepolymers; polybutadiene of those, An epoxidation butadiene, a mallein-ized butadiene, a Butadiene Acrylonitrile, A polychloroprene, a Butadiene Styrene, a polyisoprene, Rubber elastic in

the amounts of low-molecular-weight liquefied - macromolecules, such as isobutylene isoprene rubber, a fluororubber, and natural rubber; Polyethylene, Polypropylene, a polybutene, a Polly 4-methyl pentene, polystyrene, An AS resin, ABS plastics, a MBS resin, styrene-polyisoprene rubber, a polyethylene-propylene copolymer, 4-fluoride [ethylene]-6-fluoride [ethylene] copolymers; the amount prepolymers of macromolecules, such as a polycarbonate, a polyphenylene ether, a polysulfone, polyester, and polyphenylene sulfide, or oligomer; polyurethane is illustrated, and it is used suitably. Moreover, in addition to this, according to a request, various additives, such as organic [well-known], an inorganic bulking agent, a color, a pigment, a thickener, lubricant, a defoaming agent, a dispersant, a leveling agent, a photosensitizer, a flame retarder, a brightener, a polymerization inhibitor, and a thixotropy grant agent, combine suitably, and are used. As for the compound which has a reaction machine, a curing agent and a catalyst are suitably blended by the need.

[0017] The copper-clad sheet used for this invention can add an insulating inorganic bulking agent in a thermosetting resin constituent. Especially as an object for carbon-dioxide-laser perforation, in order to make the configuration of a hole homogeneous, it adds 20 to 70% of the weight preferably ten to 80% of the weight. Especially limitation does not have the kind of insulating inorganic bulking agent. Specifically, talc, baking talc, an aluminum hydroxide, a magnesium hydroxide, a kaolin, an alumina, a wollastonite, a synthetic mica, etc. are mentioned, and it is used, blending one sort or two sorts or more. A well-known heat-curing catalyst can be used for a thermosetting resin constituent to the thermosetting resin used since it was inferior to workability, economical efficiency, etc. when a cure rate is slow although hardened by heating in itself. the amount used -- the thermosetting resin 100 weight section -- receiving -- 0.005 - 10 weight section -- it is 0.01 - 5 weight section preferably

[0018] Plating containing the nickel given to a copper foil front face by this invention can use a well-known thing. Of course, apart from a nickel independent, alloy plating with other metals is sufficient. Any of electrolysis plating and electroless deposition are sufficient as the plating method. Although especially the thickness of plating is not limited, generally 1-10 micrometers is 2-5 micrometers suitably.

[0019] As for the wavelength of a carbon dioxide laser, 9.3-10.6 micrometers is used. Energy is 10-60mJ suitably. By pulse oscillation, specified quantity irradiation is carried out and perforation is carried out. a breakthrough and /blind beer -- the method and energy which irradiate the same energy and carry out perforation from the beginning to the last when opening a hole -- on the way -- the method of coming out of and making high, or making low and carrying out perforation and which method may be used

[0020] the perforation in the carbon dioxide laser of this invention -- setting -- a hole -- the barricade of copper foil occurs around As a method of carrying out etching removal of the barricade of the copper generated in the pore Although not limited especially, for example JP,02-22887,A -- said -- 02-22896 -- said -- 02-25089 -- said -- 02-25090 -- said -- 02-59337 -- said -- 02-60189 -- said -- 02-166789 -- said -- 03-25995 -- said -- 03-60183 -- said -- 03-94491 -- said -- 04-199592 -- It is based on the method (it is called the SUEP method) of carrying out dissolution removal of the surface of metal with a chemical by which it was indicated in the 04-263488 official report. Generally an etch rate is 0.02-1.0micrometers/second. It carries out. Moreover, when carrying out etching removal of the copper foil barricade of a inner layer, by carrying out etching removal of a part of front face of copper foil simultaneously, and 3-5 micrometers costing 2-7 micrometers in thickness suitably, a minute pattern can be formed in the copper foil to which copper coating of after that was carried out, and it can consider as a high-density printed wired board.

[0021] In order to prevent the injury on the table of the laser machine by laser when a hole penetrates in the rear face of a copper-clad sheet, it is also possible to only arrange a metal plate. However, the resin layer on which a part of front face [at least] of a metal plate was pasted up is preferably pasted up with the rear-face copper foil of a copper-clad multilayer board, it arranges, and a metal plate is exfoliated after penetration perforation.

[0022] the processed hole -- the case where a resin layer with a thickness of about 1 micrometer remains on a copper foil front face almost comes out to the field which the resin of internal surface copper foil and inner layer copper foil had pasted up although this resin layer is removable in advance by well-known processing generally [DESUMIA processing etc.] before etching -- liquid -- the hole of a minor diameter -- when not arriving at the interior, ****** of the resin layer which remains on the copper foil front face of a inner layer may occur, and it may become a faulty connection with copper coating therefore -- more -- suitable -- first -- gaseous-phase processing -- a hole -- the interior -- processing -- the residual layer of a resin -- perfect -- removing -- subsequently -- a hole -- etching removal of the copper foil barricade of the interior and the front reverse side is carried out Although well-known processing is generally usable as gaseous-phase processing, plasma treatment, low voltage ultraviolet-rays processing, etc. are mentioned, for example. Plasma excites a molecule partially by the RF generator, and the low-temperature plasma made to ionize is used for it. Generally the high-speed processing for which this used the shock of ion, and the moderate processing by the radical kind are used, and reactant gas and inert gas are used as a raw gas. As reactant gas, oxygen is mainly used and double-sided processing is carried out scientifically. As inert gas, argon gas is mainly used. This argon gas etc. is used and physical surface treatment is performed. Physical processing cleans a front face using the shock of ion. Wavelength is the ultraviolet rays of a short field and low ultraviolet rays are 184.9nm and 253.7nm as wavelength. The wavelength of the short wavelength region of a peak is irradiated and decomposition removal of the resin layer is carried out. a hole -- although the interior can also perform the usual copper coating -- moreover, copper coating -- a hole -- it can also be suitably filled up with a part of interior more than 80 capacity %

[0023]

[Example] An example and the example of comparison explain this invention concretely below. In addition, unless it refuses

especially, the "section" expresses the weight section.
[0024] It was made to react for 4 hours, having fused an example 12, the 2-screw (4-cyanate phenyl) propane 900 section, and the screw (4-maleimide phenyl) methane 100 section at 150 degrees C, and agitating them, and the prepolymer was obtained. This was dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide. The bisphenol A type epoxy resin (tradename : Epicoat 1001, product made from oil-ized shell epoxy <stock>) 400 section and the cresol novolak type epoxy resin (tradename : ESCN- 220 F, product made from the Sumitomo Chemical <stock>) 600 section were added to this, and dissolution mixture was carried out uniformly. Furthermore, the octylic acid zinc 0.4 section was added as a catalyst, dissolution mixture was carried out, the inorganic bulking agent (tradename : baking talc, Japanese talc <stock>, 4 micrometers of mean particle diameters) 2000 section and the black-pigment 8 section were added to this, uniform churning mixture was carried out, and Varnish A was obtained. It sank into the glass cloth with a thickness of 100 micrometers, this varnish was dried at 150 degrees C, and the content of a glass cloth created 50% of the weight of the prepreg (prepreg B) for gelation-time (at170 degree C) 102 seconds.
[0025] The electrolytic copper foil with a thickness of 12 micrometers has been arranged to a four-sheet pile and these both sides, laminate molding of this prepreg B was carried out for 2 hours under 200 degrees C, 20 kgf/cm2, and the vacuum of 30 or less mmHgs, and the double-sided copper clad laminate C was obtained. 5 micrometers of non-electrolyzed nickel plating were made to adhere to the copper foil front face of this copper clad laminate C, and it considered as the copper clad laminate D.
[0026] On the other hand, it applied and dried to the aluminum foil with a thickness of 50 micromcters, and the solution which dissolved polyvinyl alcohol in water was used as the backup sheet E. It is output 15mJ at a 900-piece direct carbon dioxide laser in 50mm angle about the hole of 100 micrometers of this upper surface after putting this backup sheet E on the inferior surface of tongue of a copper clad laminate D and laminating and sticking with a 100-degree C hot roll to diameters. Six shots irradiated and the 70-block breakthrough was opened. The lower backup sheet was removed, and after putting in into plasma equipment and processing, while spraying SUEP liquid at high speed and carrying out dissolution removal of the barricade of the front reverse side, surface copper foil was dissolved to 4 micrometers. 15 micrometers of copper coating were made to adhere after DESUMIA processing, the circuit (a line / space =50 / 50 micrometers), the pad for pewter balls, etc. were formed by the existing method, it covered with the plating resist except for the semiconductor chip loading section, the pad section for bondings, and the pewter ball pad section at least, nickel and gold plate were performed, and the printed wired board was created. The evaluation result of this printed wired board is shown in Table 1.
[0027] example 2 epoxy resin (tradename: -- Epicoat 1001, the oil-ized shell epoxy <product made from stock >> 300 section and the epoxy resin (tradename : ESCN220 F, product made from the Sumitomo Chemical <stock>) 700 section, the dicyandiamide 35 section, and the 2-ethyl-4-methyl imidazole 1 section were dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide, stirring mixture was carried out uniformly, and it considered as Varnish F) Sank in and dried to the glass cloth with a thickness of 100 micrometers, and sank into the prepreg G of 48 % of the weight of contents of a glass fabric, and the glass fabric with a thickness of 50 micrometers, they were made to dry this for gelation-time 150 seconds, and the prepreg H of 31 % of the weight of contents of a glass fabric was created for gelation-time 170 seconds.
[0028] One sheet of this prepreg G was used, the 18-micrometer electrolytic copper foil was placed up and down, laminate molding was carried out by 190 degrees C, 20 kgf/cm2, and 30mmHg, and the double-sided copper clad laminate I was obtained. After forming a circuit in the front reverse side of this board, after performing CZ processing (MEKKU), up and down, the electrolytic copper foil with a thickness [with a copper foil carrier / 5 micrometers] of 35 micrometers was put on each [every other] sheet and both its outside, laminate molding of the above-mentioned prepreg H was carried out similarly, and the multilayer board of four layers was created. then, 4 micrometers of nickel plating are made to adhere to these four lamellaes (drawing 1 (1)), the above-mentioned backup sheet E is put on the bottom, and it laminates and pastes up at 100 degrees C -- making -- this top to 15mJ(s) -- one shot and 10mJ -- one shot -- irradiating -- blind beer of 100 micrometers of apertures -- the hole was opened Furthermore, four shots irradiated by 15mJ and the breakthrough of 120 micrometers of apertures was opened (drawing 1 (2)). While performing SUEP processing to this and carrying out dissolution removal of the copper foil barricade of an inside-and-outside layer, after setting thickness of surface copper foil to 3 micrometers (drawing 1 (3)), DESUMIA processing was performed in potassium permanganate solution, copper coating was performed on the same conditions as an example 1 (drawing 1 (4)), and it considered as the printed wired board on the same conditions as an example 1. An evaluation result is shown in Table 1.
[0029] Although perforation was similarly performed by the carbon dioxide laser using the copper-clad sheet of example of comparison 1 example 1, without adhering anything to a front face, the hole did not open.
[0030] In example of comparison 2 example 2, although black magic was applied to the front face and perforation was similarly performed by the carbon dioxide laser, without adhering nickel plating to a front face, the hole did not open.
[0031] The example of comparison 3 epoxy-resin (tradename : Epicoat 5045) 2,000 section, the dicyandiamide 70 section, and the 2-ethyl imidazole 2 section were dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide, further, stirring mixture was carried out 800 ******s, uniform distribution of the insulating inorganic bulking agent of an example 1 was carried out, and the varnish was obtained. This was sunk in and dried to the glass cloth with a thickness of 100 micrometers, and the prepreg K of 35 % of the weight of glass contents was obtained for gelation-time 140 seconds (at170 degree C) using glass fabrics with a thickness of 50 micrometers for the prepreg J of 52 % of the weight of glass contents, and 180 seconds between gelling. Two sheets of this prepreg J were used, the 12-micrometer electrolytic

copper foil was put on both sides, laminate molding was carried out for 2 hours under 180 degrees C, 20 kgf/cm2, and the vacuum of 30 or less mmHgs, and the double-sided copper clad laminate L was obtained. The circuit was formed in both sides of this laminate L, Prepreg K has been arranged to the both sides after black copper-oxide processing, 12-micrometer copper foil has been arranged on each [every other] sheet and its outside, and laminate molding was carried out similarly. Using this, the breakthrough of 150 micrometers of apertures was opened with the mechanical drill, and SUEP processing was not performed, but copper coating was performed similarly, and it considered as the printed wired board similarly. An evaluation result is shown in Table 1.

[0032] After having carried out etching removal of the vertical copper foil so that it might become 100 micrometers of apertures about the copper foil of the part used as the through hole of a inner layer using the double-sided copper-clad sheet I of example of comparison 4 example 2 (drawing 2 (1)), and forming a circuit, black copper-oxide processing of the copper foil front face was carried out, Prepreg H was put on the outside, the 12-micrometer electrolytic copper foil has been arranged on the outside, laminate molding was carried out similarly, and four lamellaes were created (drawing 2 (2)). Using this multilayer board, 900 pieces and copper foil were **********ed in the position of the front face which forms a breakthrough, and the hole of 100 micrometers of apertures was opened in it. 900 holes of 100 micrometers of apertures were similarly opened in the same position also as a rear face. One patterns [900] were covered by 70 blocks, four shots of a total of 63,000 holes were covered by output 15mJ by the carbon dioxide laser from the front face, and the breakthrough was opened (drawing 2 (3)). Like the example 3 of comparison, without performing SUEP processing, the rest performed DESUMIA processing once, performed 15 micrometers of copper coating (drawing 2 (4)), formed the circuit in the front reverse side, and created the printed wired board similarly. An evaluation result is shown in Table 1.

[0033]

Table 1 Term An eye Fruit ** Example Ratio ** Example 1 2 3 4 Table rear-face land copper foil Crevice (micrometer) 0 0 0 22 Gap (micrometer) of a hole location with a inner layer - 0 0 36 a pattern piece -- and -- 0/200 0/200 55/200 52/200 Short-circuit (individual)

Glass transition temperature (degree C) 235 160 139 160 Through hole HI TOSAIKURU examination (%)

100 Cycle 1.1 1.2 1.6 3.9 300 Cycle 1.2 1.4 1.9 6.5 500 Cycle 1.4 1.6 2.8 29.9 Perforation Floor to Floor Time (Minute) 19 14 630 - Migration-proof Nature (HAST) (Omega)

An ordinary state 2x1011 - 1x1011 - 200hrs(es). 8x108 < 108 500hrs(es). 8x108 - 700hrs. 7x108 1000hrs. 2x108 [0034] It is a /block 900 holes about the crevice aperture 100 of a <measuring method> 1 front reverse side hole location, or a 200-micrometer hole. 70-block (**** 63,000 hole) creation was carried out and carried out. A carbon dioxide laser and a mechanical drill perform perforation, and it is the copper-clad sheet of one sheet. The time required for opening 63,000 holes, the crevice between the copper foil for front reverse side lands and a hole, and the maximum of gap of inner layer copper foil were shown.

2) Create similarly the board with which a hole has not opened in the example of a circuit pattern piece and a short example, and comparison, and they are a line / space =50 / 50 micrometers. After creating a tandem-type pattern, 200 patterns after etching were visually observed with the magnifying glass, and the sum total of a pattern piece and a shorting pattern was shown in the molecule.

3) It measured by the glass-transition-temperature DMA method.

4) through hole thermo-cycle examination each through hole -- a hole -- 250 micrometers of diameters of a land -- creating -- 900 holes -- front reverse side alternation -- tying -- 1 cycle -- 260 degree C, a pewter, a dipping 30-second -> room temperature, and 5 minutes It carried out up to 500 cycle and the maximum of the rate of change of resistance was shown.

5) migration-proof nature (HAST) -- a hole -- type -- it connected at a time alternately [one] with the table reverse side the through hole (100 micrometers or 150 micrometers (mechanical drill)), respectively, and a total of 50 pieces were connected, and as it became parallel by 150 micrometers between porous walls, a total of 100 sets were created, and 2 sets of this connected thing took out after predetermined-time processing in 130 degrees C, 85%RH, and 1.8VDC, and measured the insulating resistance between through holes

[0035]

[Effect of the Invention] according to the method of this invention of irradiating the carbon dioxide laser of sufficient energy to make plating containing nickel adhering to the copper foil front face of a copper clad laminate, and process copper foil from on this directly, and performing perforation, compared with mechanical drilling, it is markedly alike, and a working speed is quick and the perforation method that productivity is also sharply improvable is offered Moreover, while carrying out dissolution removal of the copper foil barricade generated in the pore after that, a part of front face of copper foil is dissolved, preferably, by being suitably referred to as 3-5 micrometers, also in the plating rise by subsequent copper coating, a minute pattern can be formed and a high-density printed wired board can be created 2-7 micrometers in residual thickness of copper foil.

[Translation done.]

DERWENT-ACC-NO: 2002-029448

DERWENT-WEEK: 200204

TITLE: Opening method for forming holes in copper-plated board by carbon dioxide laser, involves irradiating carbon dioxide laser of sufficient energy by pulse oscillation from nickel-plated side

PATENT-ASSIGNEE: MITSUBISHI GAS CHEM CO INC[MITN]

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ABSTRACTED-PUB-NO: JP2001239386A

BASIC-ABSTRACT:

NOVELTY - A plating (o) containing nickel is formed on the copper foil surface of the copper-plated board. A carbon dioxide laser of sufficient energy is directly irradiated from the nickel-coated side by the

pulse oscillation after
giving the plating and a through-hole (c) or a blind via hole (e) is formed.

USE - For forming a through-hole or blind via hole of small diameter in a
copper-plated board by using carbon dioxide laser irradiation for manufacture
of printed circuit boards.

ADVANTAGE - A through-hole or a blind via hole can be formed with a quick
working speed as compared with mechanical drilling and productivity can be
improved considerably, since a carbon dioxide laser of sufficient energy is
directly irradiated from beside a nickel plating made to adhere to the copper
foil surface of a copper cladded laminated board. A high density small-sized
printed circuit on which a minute pattern is formed, can be obtained easily for
novel semiconductor plastic packages, etc.

DESCRIPTION OF DRAWING(S) - The figure shows the copper-plated board with
penetration openings formed by carbon dioxide laser irradiation.

Through-hole c

Blind via hole e

Plating o

CHOSEN-DRAWING: Dwg.1/2

TITLE-TERMS: OPEN METHOD FORMING HOLE COPPER PLATE BOARD CARBON LASER IRRADIATE
CARBON LASER SUFFICIENT ENERGY PULSE OSCILLATING NICKEL PLATE SIDE

DERWENT-CLASS: L03 M23 P55 V04 V08 X24

CPI-CODES: L03-H04E9; M23-D05;

EPI-CODES: V04-R08; V08-A04B; X24-D03A;

SECONDARY-ACC-NO:
CPI Secondary Accession Numbers: C2002-008510
Non-CPI Secondary Accession Numbers: N2002-022828

PAT-NO: JP02001239386A

DOCUMENT-IDENTIFIER: JP 2001239386 A

TITLE: BORING METHOD BY CO2 GAS LASER

PUBN-DATE: September 4, 2001

INVENTOR-INFORMATION:

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ASSIGNEE-INFORMATION:

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APPL-NO: JP2000048537

APPL-DATE: February 25, 2000

INT-CL (IPC): B23K026/00, H05K003/00 , H05K003/46

ABSTRACT:

PROBLEM TO BE SOLVED: To provide a boring method which forms small pierced hole and/or blind-pierced hole by irradiating CO2 gas laser directly to the surface of a copper laminated plate.

SOLUTION: This boring method, installing metal plating o which includes nickel, on the copper-foil surface of the copper laminated plate, irradiates high power CO2 gas laser, the power of which is preferably selected from 10-60 mJ, directly to the surface of the copper laminated plate, boring exterior and inner copper foil to form a pierced hole c and/or a blind

pierced hole e.

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Ｈ０５Ｋ 3/00		Ｈ０５Ｋ 3/00	Ｎ	５Ｅ３４６
3/46		3/46	Ｎ	
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103:16		103:16		

審査請求　未請求　請求項の数３　ＯＬ　（全７頁）

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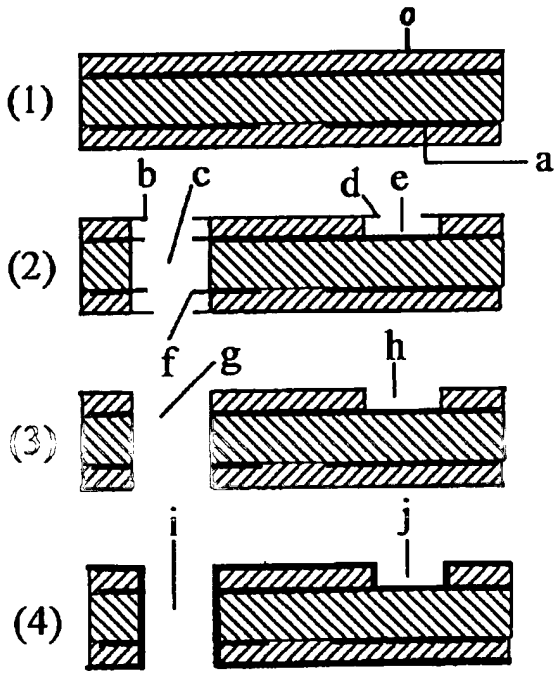
CC32 CC37 CC38 DD12 DD23
DD24 EE09 FF01 GG15 GG16
GG22

(54)【発明の名称】　炭酸ガスレーザーによる孔あけ方法

(57)【要約】　（修正有）
【課題】　銅張板の上に直接炭酸ガスレーザーを照射して小径の貫通孔及び／又はブラインドビア孔を形成する方法の提供。
【解決手段】　銅張板の銅箔表面にニッケルを含有するメッキ０を施し、この銅張板の上から、好適には、10～60mJより選ばれた高出力の炭酸ガスレーザーを直接照射して外層及び内層銅箔を孔あけ加工して貫通孔Ｃ及び／又はブラインドビア孔ｅを形成する方法。



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【特許請求の範囲】

【請求項１】　銅張板の銅箔表面にニッケルを含有するメッキを施した後、この上から、銅箔を孔あけ加工するに十分なエネルギーの炭酸ガスレーザーを、パルス発振にて直接照射して貫通孔及び／又はブラインドビア孔を形成することを特徴とする炭酸ガスレーザーによる孔あけ方法。

【請求項２】　炭酸ガスレーザーのエネルギーが、10～60mJから選ばれたエネルギーである請求項1記載の炭酸ガスレーザーによる孔あけ方法。。

【請求項３】　該炭酸ガスレーザー孔あけ後、孔周辺に発生した銅箔バリを除去するとともに、銅箔を厚さ方向に一部平面的にエッチング除去することを特徴とする請求項１又は２記載の炭酸ガスレーザーによる孔あけ方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、銅張板の銅箔表面にニッケルを含有するメッキを施した後、その上から直接炭酸ガスレーザーを照射し、小径の貫通孔及び／又はブラインドビア孔を形成する方法に関する。好適には、孔あけ後に、薬液にて孔周辺の銅箔バリを除去すると同時に銅箔を厚さ方向に一部エッチング除去し、ついで全体を銅メッキして作成される銅張板を用いて得られたプリント配線板は、小径の孔を有し、細密なパターンが形成された高密度の小型プリント配線板として、新規な半導体プラスチックパッケージ用等への使用に適している。

【０００２】

【従来の技術】従来、半導体プラスチックパッケージ等に用いられる高密度のプリント配線板は、メカニカルドリルで貫通孔あけを行っていた。近年、ますますドリルの径は小径となり、孔径が0.15mmφ以下となってきており、このような小径の孔をあける場合、ドリル径が細いため、孔あけ時にドリルが曲がる、折れる、加工速度が遅い等の欠点があり、生産性、信頼性等に問題のあるものであった。また、表裏の銅箔にあらかじめネガフィルムを使用して所定の方法で同じ大きさの孔をあけておき、更には内層の銅箔にも同様の孔を予めエッチングで形成したものを配置しておき、炭酸ガスレーザーで表裏を貫通するスルーホール用孔を形成しようとすると、内層銅箔の位置ズレ、上下の孔の位置のズレを生じ、接続不良、及び表裏のランドが形成できない等の欠点があった。

【０００３】ブラインドビア孔あけにおいては、予め表層の銅箔をエッチングしておき、この上から低エネルギーの炭酸ガスレーザーエネルギーを照射して孔あけしていた。これは表層にエッチングレジストを使用し、露光、現像、エッチング、レジスト剥離などの工程が必要であり、作業性に劣っていた。また、多層板において

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は、内層の寸法収縮によるブラインドビア孔の底部の銅箔の位置ズレなどが問題となっていた。更に近年ますます高密度化するプリント配線板において、耐熱性、耐マイグレーション性、吸湿後の電気絶縁性等が問題になってきている。

【０００４】

【発明が解決しようとする課題】本発明は、以上の問題点を解決した高密度プリント配線板を作成するための小径の孔を形成する方法を提供する。

【０００５】

【課題を解決するための手段】本発明によれば、銅張板の表面にニッケルを含有するメッキを施した後、この上から銅箔を加工するに十分なエネルギーの炭酸ガスレーザービームを直接照射することにより、貫通孔及び／又はブラインドビア孔をあけることが可能となり、高速で小径の孔が効率的に作成できる。好ましくは10～60mJから選ばれたエネルギーの炭酸ガスレーザーを直接銅箔の上から照射して貫通孔及び／又はブラインドビア孔を形成する。加工後、孔部には銅箔のバリが発生する。機械的研磨でバリをとることもできるが、寸法変化等の点から、薬液によるエッチングが好適である。孔あけ後に薬液を吹き付けるか、吸引して表層の銅箔の一部をエッチング除去すると同時に内外層の銅箔バリをもエッチング除去する。

【０００６】エッチング除去後、銅メッキでメッキアップして得られる両面銅張板を用い、表裏に回路形成を行い、定法にてプリント配線板とする。表裏の回路を細密にするためには、表裏層の銅箔を2～7μmの厚さとすることが好ましく、この場合にはショートやパターン切れ等の不良の発生もなく、高密度のプリント配線板を作成することができる。更には、加工速度はドリルであける場合に比べて格段に速く、生産性も良好で、経済性にも優れているものが得られた。

【０００７】

【発明の実施の形態】本発明は、まず銅張板の銅箔表面にニッケルを含有するメッキを施す。その後、この上から銅箔を加工するに十分なエネルギーの炭酸ガスレーザーを用いて、直接銅箔の上にエネルギーをパルス発振で照射し、貫通孔及び／又はブラインドビア孔をあける。孔あけ後、表裏及び内層の銅箔のバリが発生するが、この場合、高圧でエッチング液を吹き付けるか、吸引して孔内を通し、内外層の銅箔のバリを溶解除去する。その後、定法にて全体を銅メッキし、回路形成等を行ってプリント配線板を作成する。

【０００８】本発明で使用する銅張板を作成するのに必要な銅箔とは、一般に公知の電解銅箔が挙げられる。この銅箔は、外層板としては、好適には厚さ3～12μmの電解銅箔、内層板としては厚さ9～35μmのものが好適に使用される。

【０００９】本発明において銅張板とは、少なくとも１

層以上の銅の層が存在する銅張板、多層板であり、基材補強されたもの、フィルム基材のもの、補強基材の無い樹脂単独のもの等が使用可能である。しかしながら、寸法収縮等の点からガラス布基材銅張板が好ましい。又、高密度の回路を作成する場合、表層の銅箔は、最初から薄いものを使用できるが、好適には、9~12μmの厚い銅箔を積層成形しておいて、孔あけ後に表層の銅箔をエッチング液で2~7μm、好適には3~5μmまで薄くしたものを使用する。

【0010】銅張板の基材としては、一般に公知の、有機、無機の織布、不織布が使用できる。具体的には、無機の繊維としては、Eガラス、Sガラス、Dガラス、Mガラス等の繊維等が挙げらる。又、有機繊維としては、全芳香族ポリアミド、液晶ポリエステル、ポリベンザゾールの繊維等が挙げられる。これらは、混抄でも良い。ポリイミドフィルム等のフィルム類も使用可能である。

【0011】本発明で使用される銅張板の熱硬化性樹脂組成物の樹脂としては、一般に公知の熱硬化性樹脂が使用される。具体的には、エポキシ樹脂、多官能性シアン酸エステル樹脂、 多官能性マレイミドーシアン酸エステル樹脂、多官能性マレイミド樹脂、不飽和基含有ポリフェニレンエーテル樹脂等が挙げられ、1種或いは2種類以上が組み合わせて使用される。高い出力の炭酸ガスレーザー照射により孔あけ加工したときのスルーホール形状の点からは、ガラス転移温度が150℃以上の熱硬化性樹脂組成物が好ましく、耐湿性、耐マイグレーション性、吸湿後の電気的特性等の点から多官能性シアン酸エステル樹脂組成物が好適である。

【0012】本発明の好適な熱硬化性樹脂分である多官能性シアン酸エステル化合物とは、分子内に2個以上のシアナト基を有する化合物である。具体的に例示すると、1,3-又は1,4-ジシアナトベンゼン、1,3,5-トリシアナトベンゼン、1,3-、1,4-、1,6-、1,8-、2,6-又は2,7-ジシアナトナフタレン、1,3,6-トリシアナトナフタレン、4,4-ジシアナトビフェニル、ビス(4-ジシアナトフェニル)メタン、2,2-ビス(4-シアナトフェニル)プロパン、2,2-ビス(3,5-ジブロモー4-シアナトフェニル)プロパン、ビス(4-シアナトフェニル)エーテル、ビス(4-シアナトフェニル)チオエーテル、ビス(4-シアナトフェニル)スルホン、トリス(4-シアナトフェニル)ホスファイト、トリス(4-シアナトフェニル)ホスフェート、およびノボラックとハロゲン化シアンとの反応により得られるシアネート類などである。

【0013】これらのほかに特公昭41-1928、同43-18468、同44-4791、同45-11712、同46-41112、同47-26853及び特開昭51-63149号公報等に記載の多官能性シアン酸エステル化合物類も用いら得る。また、これら多官能性シアン酸エステル化合物のシアナト基の三量化によって形成されるトリアジン環を有する分子量400~6,000 のプレポリマーが使用される。このプレポリマーは、上記の多官能性シアン酸エステルモノマーを、例えば鉱酸、ルイス酸等の酸類;ナトリウムアルコラート等、第三級アミン類等の塩基;炭酸ナトリウム等の塩類等を触媒として重合させることにより得られる。このプレポリマー中には一部未反応のモノマーも含まれており、モノマーとプレポリマーとの混合物の形態をしており、このような原料は本発明の用途に好適に使用される。一般には可溶な有機溶剤に溶解させて使用する。

【0014】エポキシ樹脂としては、一般に公知のものが使用できる。具体的には、液状或いは固形のビスフェノールA型エポキシ樹脂、ビスフェノールF型エポキシ樹脂、フェノールノボラック型エポキシ樹脂、クレゾールノボラック型エポキシ樹脂、脂環式エポキシ樹脂、ブタジエン、ペンタジエン、ビニルシクロヘキセン、ジシクロペンチルエーテル等の二重結合をエポキシ化したポリエポキシ化合物類;ポリオール、水酸基含有シリコン樹脂類とエポハロヒドリンとの反応によって得られるポリグリシジル化合物類等が挙げられる。これらは1種或いは2種類以上が組み合わせて使用され得る。

【0015】ポリイミド樹脂としては、一般に公知のものが使用され得る。具体的には、多官能性マレイミド類とポリアミン類との反応物、特公昭57-005406 に記載の末端三重結合のポリイミド類が挙げられる。これらの熱硬化性樹脂は、単独でも使用されるが、特性のバランスを考え、適宜組み合わせて使用するのが良い。

【0016】本発明の熱硬化性樹脂組成物には、組成物本来の特性が損なわれない範囲で、所望に応じて種々の添加物を配合することができる。これらの添加物としては、不飽和ポリエステル等の重合性二重結合含有モノマー類及びそのプレポリマー類;ポリブタジエン、エポキシ化ブタジエン、マレイン化ブタジエン、ブタジエン-アクリロニトリル共重合体、ポリクロロプレン、ブタジエン-スチレン共重合体、ポリイソプレン、ブチルゴム、フッ素ゴム、天然ゴム等の低分子量液状~高分子量のelasticなゴム類;ポリエチレン、ポリプロピレン、ポリブテン、ポリ-4-メチルペンテン、ポリスチレン、AS樹脂、ABS樹脂、MBS樹脂、スチレン-イソプレンゴム、ポリエチレン-プロピレン共重合体、4-フッ化エチレン-6-フッ化エチレン共重合体類;ポリカーボネート、ポリフェニレンエーテル、ポリスルホン、ポリエステル、ポリフェニレンサルファイド等の高分子量プレポリマー若しくはオリゴマー;ポリウレタン等が例示され、適宜使用される。また、その他、公知の有機、無機の充填剤、染料、顔料、増粘剤、滑剤、消泡剤、分散剤、レベリング剤、光増感剤、難燃剤、光沢剤、重合禁止剤、チキソ性付与剤等の各種添加剤が、所望に応じて適宜組み合わせて用いられる。必要により、反応基を有する化合物は硬化剤、触媒が適宜配合される。

【0017】本発明に使用する銅張板は、熱硬化性樹脂組成物の中に、絶縁性無機充填剤を添加できる。特に炭

酸ガスレーザー孔あけ用としては、孔の形状を均質にするために10～80重量%、好ましくは、20～70重量%添加する。絶縁性無機充填剤の種類は特に限定はない。具体的には、タルク、焼成タルク、水酸化アルミニウム、水酸化マグネシウム、カオリン、アルミナ、ウオラストナイト、合成雲母等が挙げられ、１種或いは２種以上を配合して使用する。熱硬化性樹脂組成物は、それ自体は加熱により硬化するが硬化速度が遅い場合には作業性、経済性等に劣るため使用した熱硬化性樹脂に対して公知の熱硬化触媒を用い得る。使用量は、熱硬化性樹脂100重量部に対して0.005～10重量部、好ましくは0.01～5重量部である。

【００１８】本発明で銅箔表面に施すニッケルを含有するメッキは、公知のものが使用できる。もちろん、ニッケル単独とは別に、他の金属との合金メッキでも良い。メッキ方法は電解メッキ、無電解メッキのいずれでもよい。メッキの厚さは特に限定しないが、一般には１～１０μm、好適には２～５μmである。

【００１９】炭酸ガスレーザーの波長は、9.3～10.6μmが使用される。エネルギーは、好適には10～60mJ で、パルス発振で所定量照射して孔あけする。貫通孔及び／ブラインドビア孔をあける場合、最初から最後まで同一エネルギーを照射して孔あけする方法、エネルギーを途中で高くするか、低くして孔あけする方法、いずれの方法でも良い。

【００２０】本発明の炭酸ガスレーザーでの孔あけにおいて、孔周囲に銅箔のバリが発生する。孔部に発生した銅のバリをエッチング除去する方法としては、特に限定しないが、例えば、特開平02-22887、同02-22896、同02-25089、同02-25090、同02-59337、同02-60189、同02-166789、同03-25995、同03-60183、同03-94491、同04-199592、同04-263488号公報で開示された、薬品で金属表面を溶解除去する方法（ＳＵＥＰ法と呼ぶ）による。エッチング速度は、一般には0.02～1.0μm/秒 で行う。また、内層の銅箔バリをエッチング除去する場合、同時に銅箔の表面の一部をもエッチング除去し、厚さ2～7μm、好適には３～５μmとすることにより、その後の銅メッキされた銅箔に細密なパターンを形成でき、高密度のプリント配線板とすることができる。

【００２１】銅張板の裏面には、孔が貫通した場合のレーザーによるレーザーマシーンのテーブルの損傷を防ぐために、単に金属板を配置することも可能である。しかし好ましくは、金属板の表面の少なくとも一部を接着させた樹脂層を銅張多層板の裏面銅箔と接着させて配置し、貫通孔あけ後に金属板を剥離する。

【００２２】加工された孔内部の表層銅箔、内層銅箔の樹脂が接着していた面には厚さ約1μmの樹脂層が銅箔表面に残存する場合が殆どである。この樹脂層を、エッチング前にデスミア処理等の一般に公知の処理で事前に除去が可能であるが、液が小径の孔内部に到達しない場合、内層の銅箔表面に残存する樹脂層の除去残が発生し、銅メッキとの接続不良になる場合がある。従って、より好適には、まず気相処理で孔内部を処理して樹脂の残存層を完全に除去し、次いで孔内部及び表裏の銅箔バリをエッチング除去する。気相処理としては一般に公知の処理が使用可能であるが、例えばプラズマ処理、低圧紫外線処理等が挙げられる。プラズマは、高周波電源により分子を部分的に励起し、電離させた低温プラズマを用いる。これは、イオンの衝撃を利用した高速の処理、ラジカル種による穏やかな処理が一般には使用され、処理ガスとして、反応性ガス、不活性ガスが使用される。反応性ガスとしては、主に酸素が使用され、科学的に両面処理をする。不活性ガスとしては、主にアルゴンガスを使用する。このアルゴンガス等を使用し、物理的な表面処理を行う。物理的な処理は、イオンの衝撃を利用して表面をクリーニングする。低紫外線は、波長が短い領域の紫外線であり、波長として、184.9nm、253.7nm がピークの短波長域の波長を照射し、樹脂層を分解除去する。孔内部は、通常の銅メッキを施すことも可能であるが、また銅メッキで孔内部を一部、好適には80容積%以上充填することもできる。

【００２３】

【実施例】以下に実施例、比較例で本発明を具体的に説明する。尚、特に断らない限り、『部』は重量部を表す。

【００２４】実施例１

2,2-ビス(4-シアナトフェニル)プロパン900部、ビス(4-マレイミドフェニル)メタン100部を150℃で熔融させ、撹拌しながら4時間反応させ、プレポリマーを得た。これをメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解した。これにビスフェノールA型エポキシ樹脂(商品名:エピコート1001、油化シェルエポキシ<株>製)400部、クレゾールノボラック型エポキシ樹脂(商品名:ESCN-220F、住友化学工業<株>製)600部を加え、均一に溶解混合した。更に触媒としてオクチル酸亜鉛0.4部を加え、溶解混合し、これに無機充填剤(商品名:焼成タルク、日本タルク<株>、平均粒子径4μm)2000部、及び黒色顔料8部を加え、均一撹拌混合してワニスAを得た。このワニスを厚さ100μmのガラス織布に含浸し150℃で乾燥して、ゲル化時間(at170℃)102秒、ガラス織布の含有量が50重量%のプリプレグ(プリプレグB)を作成した。

【００２５】このプリプレグBを４枚重ね、この両面に厚さ12μmの電解銅箔を配置し、200℃、20kgf/cm²、30mmHg以下の真空下で2時間積層成形し、両面銅張積層板Cを得た。　この銅張積層板Cの銅箔表面に無電解ニッケルメッキを5μm付着させ、銅張積層板Dとした。

【００２６】一方、ポリビニルアルコールを水に溶解した水溶液を、厚さ50μmのアルミニウム箔に塗布、乾燥してバックアップシートEとした。このバックアップシ

ートEを銅張積層板Dの下面に置き、100℃のホットロールでラミネートして貼り付けた後、この上面から径100μmの孔を50mm角内に900個直接炭酸ガスレーザーで、出力15mJ で６ショット照射して、70ブロックの貫通孔をあけた。下側のバックアップシートを除去し、プラズマ装置の中に入れて処理した後、ＳＵＥＰ液を高速で吹き付けて、表裏のバリを溶解除去すると同時に、表層の銅箔を4μmまで溶解した。デスミア処理後、銅メッキを15μm付着させ、既存の方法にて回路(ライン/スペース=50/50μm)、ハンダボール用パッド等を形成し、少なくとも半導体チップ搭載部、ボンディング用パッド部、ハンダボールパッド部を除いてメッキレジストで被覆し、ニッケル、金メッキを施し、プリント配線板を作成した。このプリント配線板の評価結果を表1に示す。

【００２７】実施例２

エポキシ樹脂（商品名：エピコート1001、油化シェルエポキシ<株>製> 300部、及びエポキシ樹脂（商品名：ESCN220F、住友化学工業<株>製）700部、ジシアンジアミド35部、2-エチル-4-メチルイミダゾール1部をメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解し、均一に撹拌混合してワニスFとした。これを厚さ100μmのガラス織布に含浸、乾燥して、ゲル化時間150秒、ガラス布の含有量48重量%のプリプレグG、厚さ50μmのガラス布に含浸、乾燥させてゲル化時間170秒、ガラス布の含有量31重量%のプリプレグHを作成した。

【００２８】このプリプレグGを1枚使用し、上下に18μmの電解銅箔を置き、190℃、20kgf/cm²、30mmHgで積層成形し、両面銅張積層板Iを得た。この板の表裏に回路を形成後、CZ処理（メック社）を施した後、上下に上記プリプレグHを各１枚置き、その両外側に３５μmの銅箔キャリア付きの厚さ５μmの電解銅箔を重ね、同様に積層成形して4層の多層板を作成した。その後、この４層板にニッケルメッキを４μm付着させ（図１（１））、下側に上記バックアップシートEを置き、100℃でラミネートして接着させ、この上側から15mJで１ショット、１０mJで１ショット照射し、孔径100μmのブラインドビア孔をあけた。更に、15mJで４ショット照射して孔径120μmの貫通孔をあけた（図１（２））。これにSUEP処理を行い、内外層の銅箔バリを溶解除去するとともに、表層の銅箔の厚みを3μmとした後（図１（３））、過マンガン酸カリウム水溶液にてデスミア処理を行なって、実施例１と同様の条件で銅メッキを行い（図１（４））、実施例１同様の条件でプリント配線板とした。評価結果を表１に示す。

【００２９】比較例１

＊実施例１の銅張板を用い、表面に何も付着せずに炭酸ガスレーザーで同様に孔あけを行なったが、孔はあかなかった。

【００３０】比較例２

実施例２において、表面にニッケルメッキを付着せずに、表面に黒マジックを塗って同様に炭酸ガスレーザーで孔あけを行ったが、孔はあかなかった。

【００３１】比較例３

エポキシ樹脂（商品名：エピコート5045)2,000部、ジシアンジアミド70部、2ーエチルイミダゾール2部をメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解し、更に実施例１の絶縁性無機充填剤を800部加え、撹拌混合して均一分散してワニスを得た。これを厚さ100μmのガラス織布に含浸、乾燥して、ゲル化時間140秒（at170℃），ガラス含有量52重量%のプリプレグJ、ゲル化間180秒、厚さ50μmのガラスクロスを使用しガラス含有量35重量%のプリプレグKを得た。このプリプレグJを2枚使用し、両面に12μmの電解銅箔を置き、180℃、20kgf/cm²、30mmHg以下の真空下で2時間積層成形して両面銅張積層板Lを得た。この積層板Lの両面に回路を形成し、黒色酸化銅処理後、その両面にプリプレグKを各1枚置き、その外側に12μm銅箔を配置し、同様に積層成形した。これを用い、メカニカルドリルにて孔径150μmの貫通孔をあけ、SUEP処理を行わず同様に銅メッキを施し、同様にプリント配線板とした。評価結果を表１に示す。

【００３２】比較例４

実施例２の両面銅張板Iを用い（図２（１））、内層のスルーホールとなる箇所の銅箔を孔径100μmとなるように上下銅箔をエッチング除去し、回路を形成した後、銅箔表面を黒色酸化銅処理して、その外側にプリプレグHを置き、その外側に12μmの電解銅箔を配置し、同様に積層成形して４層板を作成した（図２（2））。この多層板を用い、貫通孔を形成する表面の位置に孔径100μmの孔を900個、銅箔をエッチングしてあけた。同様に裏面にも同じ位置に孔径100μmの孔を900個あけた。１パターン900個を70ブロック、合計63,000の孔を、表面から炭酸ガスレーザーで、出力15mJにて4ショットかけ、貫通孔をあけた（図２（3））。後は比較例３と同様にして、SUEP処理を行わずに、デスミア処理を１回施し、銅メッキを15μm施し（図２（４））、表裏に回路を形成し、同様にプリント配線板を作成した。評価結果を表１に示す。

【００３３】

表1

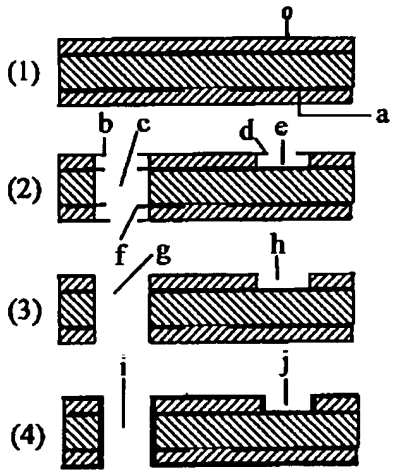
項　　目	実施例 1	実施例 2	比較例 3	比較例 4
表裏面ランド銅箔との隙間（μm）	0	0	0	22

９				１０
内層との孔位置のズレ（μｍ）	―	0	0	36
パターン切れ及び	0/200	0/200	55/200	52/200
ショート （個）				
ガラス転移温度（℃）	235	160	139	160
スルーホール・ヒー				
トサイクル試験(%)				
100 サイクル	1.1	1.2	1.6	3.9
300 サイクル	1.2	1.4	1.9	6.5
500 サイクル	1.4	1.6	2.8	29.9
孔あけ加工時間（分）	１９	１４	６３０	―
耐マイグレーション性(HAST)（Ω）				
常態	$2x10^{11}$	―	$1x10^{11}$	―
200hrs.	$8x10^{8}$		$< 10^{8}$	
500hrs.	$8x10^{8}$		―	
700hrs.	$7x10^{8}$			
1000hrs.	$2x10^{8}$			

【００３４】<測定方法>
1)表裏孔位置の隙間
孔径100又は200μ■の孔を900孔/ブロック として70ブロック（孔計63,000孔）作成した。炭酸ガスレーザー及びメカニカルドリルで孔あけを行ない、１枚の銅張板に６３,000孔をあけるに要した時間、及び表裏ランド用銅箔と孔との隙間、及び内層銅箔のズレの最大値を示した。
2)回路パターン切れ、及びショート
実施例、比較例で、孔のあいていない板を同様に作成し、ライン/スペース＝50/50μ■ の櫛型パターンを作成した後、拡大鏡でエッチング後の200パターンを目視にて観察し、パターン切れ、及びショートしているパターンの合計を分子に示した。
3)ガラス転移温度
ＤＭＡ法にて測定した。
4)スルーホール・ヒートサイクル試験
各スルーホール孔にランド径250μ■を作成し、900孔を表裏交互につなぎ、1サイクルが、260℃・ハンダ・浸せき30秒→室温・5分 で、500サイクルまで実施し、抵抗値の変化率の最大値を示した。
5)耐マイグレーション性(HAST)
孔形100μ■又は150μ■（メカニカルドリル）のスルーホールをそれぞれ表裏交互に１個ずつつないで、合計５０個つなぎ、このつないだもの２組が孔壁間１５０μｍで平行となるようにして、合計100セット作成し、130℃、85%RH、1.8VDCにて所定時間処理後に、取り出し、スルーホール間の絶縁抵抗値を測定した。
【００３５】
【発明の効果】銅張積層板の銅箔表面にニッケルを含有するメッキを付着させ、この上から、銅箔を加工するに十分なエネルギーの炭酸ガスレーザーを直接照射して孔あけを行う本発明の方法によれば、メカニカルドリリングに比べて格段に加工速度が速く、生産性も大幅に改善できる孔あけ方法が提供される。又、その後、孔部に発＊生した銅箔バリを溶解除去すると同時に、銅箔の表面の一部を溶解し、好ましくは銅箔の残存厚さ2～7μ■、好適には3～５μｍとすることにより、その後の銅メッキによるメッキアップにおいても、細密パターンを形成することができ、高密度のプリント配線板を作成することができる。

【図面の簡単な説明】
【図１】実施例2の銅張板への炭酸ガスレーザーによる貫通孔あけ及びブラインドビア孔あけ（２）、ＳＵＥＰによる表層と内層銅箔のバリ除去及び表層の銅箔のエッチング（３）、銅メッキ（４）の工程図である。
【図２】比較例４の両面銅張多層板の炭酸ガスレーザーによる孔あけ及び銅メッキの工程図である（ＳＵＥＰ無し）。
【符号の説明】
a　４層板の内層回路
b　炭酸ガスレーザーの貫通孔あけで外層に発生した銅箔バリ
c　孔あけされた貫通孔部
d　炭酸ガスレーザーのブラインドビア孔あけで外層に発生した銅箔バリ
e　孔あけされたブラインドビア孔部
f　内層銅箔バリ
g　ＳＵＥＰ処理で銅箔バリが除去された貫通孔部
h　ＳＵＥＰ処理で銅箔バリが除去されたブラインドビア孔部
i　スルーホールメッキされた貫通孔
j　銅メッキされたブラインドビア孔部
k　外層銅箔をエッチング除去した貫通孔形成部
l　内層銅箔をエッチング除去した貫通孔形成部
m　孔壁とズレを生じた内層銅箔部
n　銅メッキされたSUEP処理していない貫通孔部
o　ニッケルメッキされた外層銅箔

【図1】



【図2】